VOLUME V #1 JUNE 1989 PRICE $3.50

FOR THE DESIGN, CONSTRUCTION AND ENJOYMENT

EXPERIMENTAL MUSICAL INSTRUMENTS

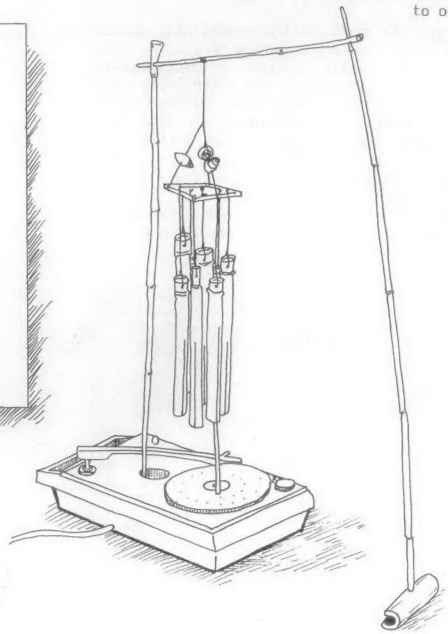
OF NEW SOUND SOURCES

MACHINES & MIRLITONS & MORE

With this issue EMI begins its fifth year of publication. (The editor's "State of the Newsletter" address, a version of which appears each year at this time, can be found on page 19.) As always, we have a full complement of diverse and interesting articles. In addition to the music machines piece (highlighted below), there is a study on MIRLITONS -- just the sort of slightly obscure but very interesting topic that EMI loves. What is a mirliton? Turn to page 4. We also have a look at Hans Reichel's pick-behind-the-bridge guitar, with its elegantly simple method for isolating string harmonics (page 14), and a review of three of the most important extant sources we have on early European instruments (page 16).

And more. Welcome to our fifth year.

IN THIS ISSUE



THE DRAWING AT RIGHT shows one player from an orchestra of self playing random music machines made by the Australian builder Ernie Althoff. His article begins on page 9.

LETTERS

AS A SUBSCRIBER TO EMI, A MUSICAL SAWYER AND MANDOLINE PLAYER, I hope that you can shed some light on a question I've had in my mind for a long time. Eric Sloan, in one of his books on early day America, wrote of a "devil's fiddle" which was a huge sound box. It could be somehow played with a rope-strung bow, and could apparently make a massively loud grunting sound. It was said to have a sound which carried for miles.

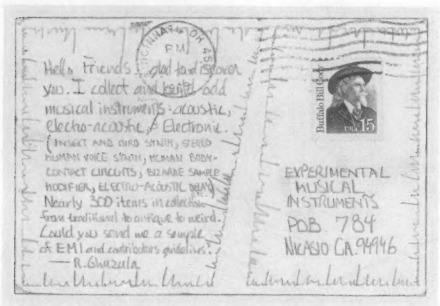
I own a large adobe fort in which is a 360 seat restaurant. It's located out in the country, 990' above and southwest of Denver, on a high bluff with several miles open view. It might be an ideal place for such a fiddle which guests could use to amuse themselves (and us). Have you ever seen any plans for such an instrument, and would there be any way to get various "notes"?

Perhaps you or one of your readers may have an idea or some plans. Hoping to hear from you.

Sam'l P. Arnold
The Fort
19192 Route 8
Morrison, CO 80465

GLAD TOAD IS COVER YOU ...
...GLAD TO DISCOVER YOU

EMI recently received the beautifully scribed postcard shown here, requesting a sample issue. Heightening the exotic elegance of the penmanship was this truly mysterious and portentous occurrence: The first line, partially obscured by the postmark, appeared at first glance to read "Glad toad is cover you." There can be little doubt that this is some sort of cosmic quasi-religious salutation, along the lines of "The Force be with you." EMI apparently has been placed under the protection of a supernatural power hitherto unknown, possibly to serve as its chosen medium. We await the next communication.



TILLMAN SCHAFER'S 19-TONE BARS

John Chalmers' article "The 19-Tone Instruments of W.A. Piehl and Tillman Schafer," appearing in EMI's last issue, described an electrically-activated metal percussion bar instrument built by Tillman Schafer in 19 tone equal temperament. The electrico-mechanical striking system for the instrument is now long gone, but the bars remain. They have found their way into the possession of microtonalist Buzz Kimball, who has suspended them in clusters to make The Great Chimes in 19 Equal. Buzz has been kind enough to send a photograph, and it appears at right (facing page).

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EXPERIMENTAL MUSICAL INSTRUMENTS
Newsletter for the Design, Construction and Enjoyment of New Sound Sources

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Subscribers can place relevant classified ads of up to 40 words without charge, and they will receive a 15% discount on display ads.

SUBMISSIONS: We welcome submissions of articles relating to new or unusual musical instruments. A query letter or phone call is suggested before sending articles. Include a return envelope with submissions.

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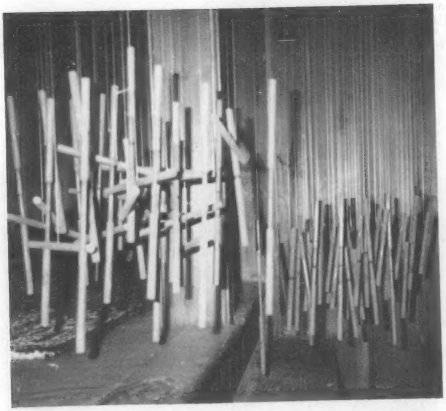


Photo by Buzz Kimball

STILL MORE SHAPES AND FORMS: Catherine Favre has sent the photograph below of one of her recently completed instruments, a fretted, plucked instrument with many violin-like features. The back and sides are carved from a single 3½" slab of quilted maple. The bridge is high, but solid, not carved in the patterns of a violin bridge. The top is highly arched. The strings are steel. The asymmetric scroll carving is reminiscent of a wave; the quilted maple grain has a rippling watery quality; and a dolphin shape is carved in the bridge. The shape of the soundhole suggests a yin-yang symbol.

Catherine Favre makes classical and baroque violins, violas, cellos and custom order string instruments, as well as the Magical Moon Harp, an easy - to - play zither, in her shop south of San Francisco (Box 252, Half Moon Bay, CA 94019).

FROM THE PAGES OF EXPERIMENTAL MUSICAL INSTRUMENTS, VOLUME IV

EMI'S NEWEST CASSETTE TAPE NOW AVAILABLE

Yes! **From the Pages of Experimental Musical Instruments, Volume IV** is being released concurrently with this issue. It contains music from instruments featured in the six issues of EMI Volume IV, spanning the period from mid-1988 through mid-1989. Instruments by twelve or more different builders can be heard, providing an excellent complement in sound to the year's articles.

As with EMI's previous cassettes, the pieces are wildly diverse, with strange & familiar, soothing & startling, silly & serious all getting more or less equal time. Information on the instruments is included on an inserted sheet, replacing the tiny booklets that came with the earlier volumes. (Those booklets were fun, but impractical. They have now been replaced by folded sheets in later "pressings" of the earlier volumes as well. The same information appears on both the sheets and the original booklets.)

The Volume IV tape, as well as Volumes I, II and III, are available to EMI subscribers for $6 apiece, and to non-subscribers for $8.50. Checks should be made out to Experimental Musical Instruments, PO Box 784, Nicasio, CA 94946. More information on the new tape appears in the flyer sent with this issue to subscribers. For convenience, if you have it on hand, you may wish to use EMI's order form envelope.

CORRECTIONS

The photograph of the Spiral Clef, plucked string instrument made by William Eaton, was printed upside down on page 12 of EMI's April issue. Yes, you can just turn the page over to see it correctly. Still, this was a travesty for such an extraordinarily beautiful instrument, and EMI apologizes to the builder and to the readers for the mistake.

DID YOU RECEIVE A DEFECTIVE COPY OF EMI'S APRIL ISSUE?

Due to a problem at the bindery, an unknown number of faulty copies of Vol. IV #6 went out in our last mailing, with some pages duplicated, and pages 9-16 missing. The defective copies appear to have gone mostly to zip codes above 95000 in the US, and to some Canadian and overseas readers. If you received one of them and haven't let us know yet, please send a postcard. We'll send a replacement, plus extend your subscription an extra issue for your trouble. Many thanks.

3

MIRLITONS -- Kazoos and Beyond

By Bart Hopkin

Think of a lightweight, non-rigid diaphragm placed in close proximity to a sound source.

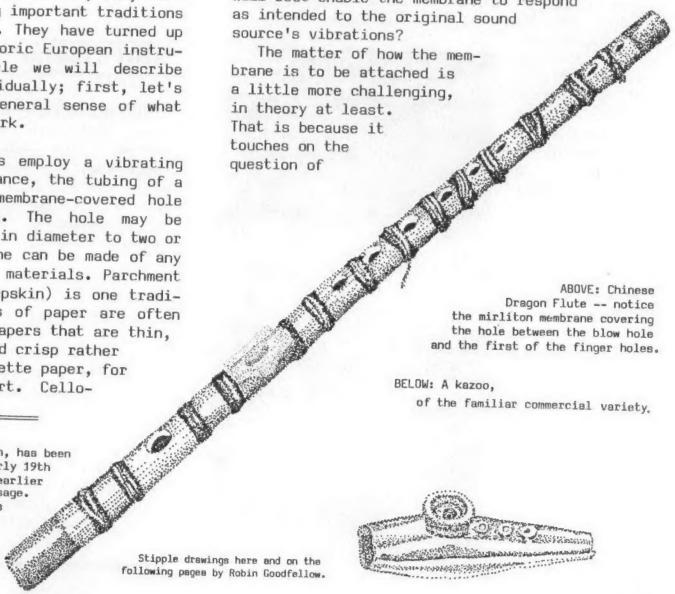
Such a diaphragm will tend to vibrate in sympathy with the sound source, as long as it is freely mounted and unimpeded in its movement. If it is content to simply reproduce the original pattern of vibration, the audible effect of its response will be negligible. But in some circumstances a diaphragm will, by virtue of something about its own anatomy or the way it is mounted, reproduce the original fundamental frequency with drastically altered timbral characteristics. Then the sound of even a very small diaphragm can make a big difference in the composite audible effect.

Instruments which use small attached membranes like this to deliberately alter an original sound are called mirlitons.[1] The effect is usually a sort of buzzing which is added to the natural sound. The buzzing may be quite coarse and tend to dominate the composite sound, or may be refined to where it just injects a fine edge. The mirlitons most familiar to us twentieth century western types are kazoos, which are made to modify the sound of the human voice. While instrumental (non-vocal) mirlitons may seem exotic, they certainly do exist, representing important traditions in Asia and parts of Africa. They have turned up as well in at least two historic European instruments. Later in this article we will describe some of these devices individually; first, let's see if we can get a more general sense of what mirlitons are and how they work.

The majority of mirlitons employ a vibrating air chamber -- as, for instance, the tubing of a wind instrument -- with a membrane-covered hole somewhere along its length. The hole may be anywhere from a quarter-inch in diameter to two or three times that. The membrane can be made of any of a variety of light, thin materials. Parchment (which is fine, treated sheepskin) is one traditional source. Various sorts of paper are often used, with a preference for papers that are thin, reasonably water resistant and crisp rather than soft and fluffy -- cigarette paper, for example, being a preferred sort. Cellophane, such as everyday kitchen plastic wrap, works well, as does in some cases aluminum foil. Goldbeater's skin, which is made of very thin prepared animal or other membrane of some sort, has been used. Treated silks have been used. Onion skin appeared on some early European instruments. The natural membrane that surrounds the unhatched eggs of certain spider species is used in several African instruments, as is the peritoneum of oxen, and small animal skin. One can also make mirlitons that are "idiomembranal," meaning that the membrane is of a piece with the body of the instrument. To do this, a small area in the wall of a reed pipe is scraped thin enough to serve as its own self-contained membrane.

Creating a membrane arrangement that buzzes as it is supposed to need not be terribly difficult, but there are some factors to consider. Choosing an appropriate material for the membrane is one: heavy materials may not be responsive to high frequency, low amplitude or low pressure vibrations. Another factor is the size of the hole that the membrane covers. Locating it in an effective place along the wall of the air chamber is important for some instruments and less vital for others. If, in a given instance, tradition does not answer these questions already, then acoustic common sense can certainly help: what sort of material, size and placement will best enable the membrane to respond as intended to the original sound source's vibrations?

The matter of how the membrane is to be attached is a little more challenging, in theory at least. That is because it touches on the question of



ABOVE: Chinese Dragon Flute -- notice the mirliton membrane covering the hole between the blow hole and the first of the finger holes.

BELOW: A kazoo, of the familiar commercial variety.

Stipple drawings here and on the following pages by Robin Goodfellow.

[1]The word "mirliton," French in origin, has been used in English at least since the early 19th century, although its intent in this earlier English usage may not match current usage. The specific meaning appearing in this article has been accepted by organologists following Francis Galpin's use of the word after the first third of the current century.

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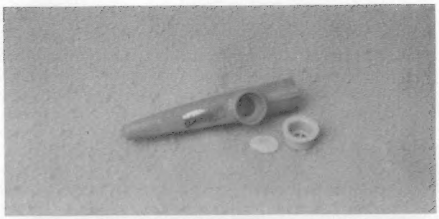
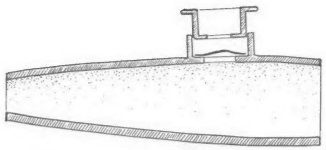




KAZOO INNARDS: At left, the familiar kazoo with the membrane and the cap that holds it in the cylinder removed. At right, a cross section diagram showing the air column, membrane and cap (slightly raised from its normal position).

just what the membrane is doing to produce such an unlikely sound. After some digging around in the literature, I've found no discussion of this question in print. The thoughts that follow here are my own, variously augmented, modified and reinforced by communications with Professor Donald Hall (EMI's regular referee for topics in musical acoustics), and physicist & performing musician Dr. John Guillory.

The essential element in the mirliton effect is that the membrane responds in a non-linear fashion to the driving force, even as its fundamental frequency remains identical to that of the driver. While the pattern of the original vibration is normally relatively smooth and sinusoidal, the membrane response may be "clipped" or otherwise disrupted, creating a more complex vibration (interpretable, both mathematically and to the ear, as having additional frequencies injected).

How does this nonlinearity come about?

A membrane which is smoothly and very tightly stretched over the hole, and which is securely and uniformly affixed to the body all around the rim of the hole, generally does not possess the required perversity. It won't add anything to the natural sound. To get the desired result, there should be some play in the physical system. There are two main ways this can enter the picture.

One way comes about when the membrane is unstretched or only loosely stretched. If unstretched, the surface may have a slightly irregular shape, or, ideally, be rounded upward with a bit of a pucker or crown. Why the looseness or arch? It allows the membrane in effect to flap, rather than engaging in anything resembling harmonic motion as a nicely stretched membrane would be inclined to do. If the membrane has the crown, it may "saucer" back and forth between two relatively stable states, buckling abruptly from one to the other when a threshold pressure is applied. It can perfectly well do this at the fundamental frequency of the original sound that drives it, making it in effect agree with the sound source in pitch, but the resulting timbre will be markedly different. The slight looseness of the membrane is one of the requirements voiced by experienced builders of certain African mirliton instruments, and I notice that the diaphragm on a commercially-made kazoo that I happen to have on hand possesses the slight crown.

The other way that nonlinearity can appear in the system comes about when the membrane is mounted in a manner that allows it to rattle against something. That something might be the edge of the hole, if whatever holds it in place does not make it snug right around the rim, but instead does the holding some distance back from the rim. It is not hard to imagine that such a rattle, while once again rattling in agreement with the fundamental frequency of the driving vibration, would add a very different sound quality to the mix. Analogously, such clipped vibration curves occur in some other instruments with partially inhibited vibrating elements, like trumpet marines with their buzzing bridges, and beating reeds not mitigated by an adjoining air column. These instruments, as a result, have a characteristically edgy tone quality not unlike a mirliton.

Experience with comb and tissue paper (a popular homemade mirliton) convinces me that this kind of rattling is a factor in at least some mirlitons, though it is not essential to all. With comb and tissue the player can directly feel, control and modify the degree of contact between the comb and the tissue as it vibrates, all with unmistakable audible results.

Mirlitons for wind instruments with vibrating air columns (including all typical woodwinds and brass) present special problems in their design. Because the membrane-covered hole must be along a tube which is at the same time determining the vibrating length and pitch of the instrument, the seal around the membrane must be air-tight -- otherwise it will act just like a leaky pad on an orchestral flute. This is immaterial with kazoos, where the pitch is determined by the singing voice, and the tube's length and degree of leakiness are not important. For mirliton flutes and brass, part of the maker's art is to somehow make the diaphragm loose enough to buzz effectively, yet firm and snug enough not to disrupt the vibrating air column.

Mirlitons are capable of some glorious special effects. Direct contact with the fingers on the

membrane (possible with some instruments) can produce an array of changing timbres. Less directly, one can create a partially enclosed air cavity over the membrane by cupping the hand. Altering this air cavity substantially affects the way the membrane operates, and can also in effect turn it off.

DESCRIPTIONS OF INSTRUMENTS

Voice Mirlitons -- including Kazoo, Bazoo, Bazooka, Zobo, Zazah, Akasitori, Bigophone, Cantophone, Duderli, Varinette, Merlotina, Strahlorgeli, etc., etc., etc.

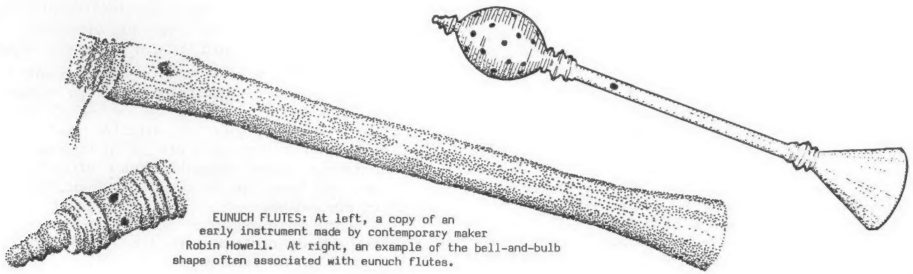
Most people reading this will already be familiar with kazoos. The kind that are found in toy shops and in the knick knack shelves of music stores usually consist of a boat-shaped tube of five inches or so, with a short, broad cylinder rising from the top near the middle. The membrane is in the cylinder, set over a hole about a half inch in diameter.

Because the actual shape of the instrument doesn't matter much as long as certain basic requirements are met, kazoos have often been made in fanciful shapes. Frequently they have been made to resemble more respectable instruments. Kazoos undergo periodic revivals in popularity; the American jug band craze of the fifties was preceded by the appearance of all-kazoo bands on European streets in the thirties and a vaudeville kazoo craze in the twenties.

Voice mirlitons in various forms have been known and used in Europe over the entire period for which we have dependable evidence. In **Harmonie Universelle** (1637) Marin Mersenne describes the eunuch flute (sometimes called onion flute), and specimens of the same instrument survive from later centuries. In contrast to their mass-produced descendants, they were often beautifully crafted. Typically, they were comprised of a tube open and flared at one end, and at the other closed by the membrane. Over the membrane end was a protective cap, carved in a globular shape and perforated with many holes to let the sound out. Another hole was located along the side of the instrument near the membrane end, and into this the player sang or spoke. As with later kazoos, an effort was sometimes made to make the eunuch flute resemble other instruments, by, for example, the addition of (nonfunctional) finger holes along the tube. Mersenne found the sound of the eunuch flutes charming. He described them playing music in four or five parts, and gave reasons to consider them superior to consorts either of other flutes or of voices.

From high culture to children's lore: I have often encountered references to comb & tissue paper, presented (much like my earlier reference in this article) as something familiar to everyone from childhood and needing no description or elaboration. Personally, no one ever told me about comb & tissue paper when I was a child, so until recently the references were lost on me and I remained in the dark. Finally, in preparation for this article I did some exploratory fooling around, and also interrogated someone who I discovered had not suffered the same cultural deprivation in childhood. Not surprisingly, it turns out that it's easy make a functioning mirliton of this sort. There may be other ways of doing it, but I found that this basic arrangement works well: A piece of tin foil, candy wrapper, wax paper or such is partially folded over a comb so that one side of the comb is covered and the other mostly exposed. The player vocalizes with lips pressed directly against the teeth on the exposed side of the comb. That sets the paper on the other side to singing in a most peculiar voice. Comb and tissue is a fully exposed, open air mirliton, and that quality has some great advantages. The diaphragm is completely accessible, and it is natural and easy to manipulate the tone by altering how the paper is held, using different pressure points and such, all to great effect.

There are also non-western voice mirlitons, such as the eggwara and the koneng, gourd instruments of Uganda. Other African instruments use horn or cane for the body, and spider's egg membranes are common for the diaphragm. In northwestern India and Bangladesh can be found the Nyastaranga, a unique variation on the type: It is a small brass trumpet-shaped device, with a membrane of rice paper over the small end. Two such instruments are played at once; the player presses them against his throat over the larynx,



EUNUCH FLUTES: At left, a copy of an early instrument made by contemporary maker Robin Howell. At right, an example of the bell-and-bulb shape often associated with eunuch flutes.

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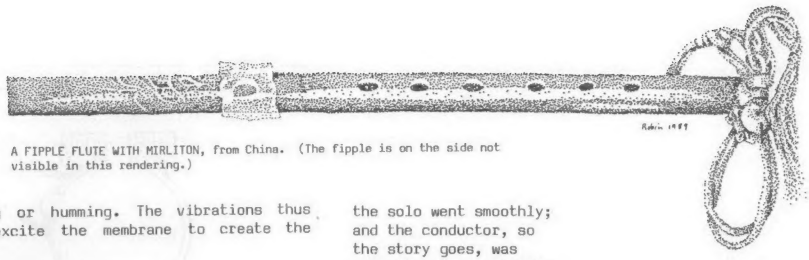


A FIPPLE FLUTE WITH MIRLITON, from China. (The fipple is on the side not visible in this rendering.)

while singing or humming. The vibrations thus transmitted excite the membrane to create the effect.

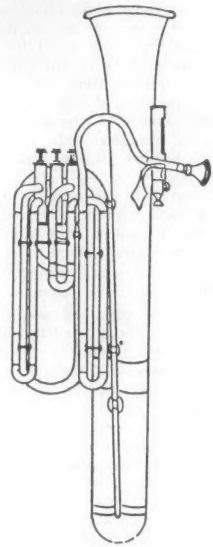
Mirliton Aerophones

The most prominent mirliton flutes are certain members of the di, or ti-tzu family in China. It is an ancient lineage, extending to the Han Dynasty (around the time of Christ), but the characteristic mirliton membrane was not added to the flute until sometime during the Ming Dynasty thirteen centuries later. The instrument has had a prominent role in both popular and high culture. A standard form of the modern mirliton instrument is called the Dragon Flute, reflecting a ceremonial association with dragons. It is a side-blown flute of bamboo, stopped at one end by a natural node in the bamboo. There are normally six fingerholes, and a range of about two octaves. Between the blowhole and the first fingerhole is an extra hole, identical in size to the fingerholes: this is the hole for the membrane. The membrane is made from a thin, natural tissue from the inside of a bamboo stem. It is stuck over the hole using a garlic juice glue: a clove of garlic is cut off near the top to form a flat surface, crosshatched with a knife to let the juices flow, and then squished over the hole to leave a sticky residue. The resulting adhesive remains flexible even after drying. When the membrane is applied, it should be stretched smooth, but it mustn't be too tight or it won't sound. Breathing on it may help if it doesn't speak initially. The mirliton adds a distinct sharp edge to an otherwise airy flute tone, and increases the effective volume very substantially, especially on high notes.

The di flute's cousin in Korea is the taegum. It too has six finger holes and a membrane hole, but is larger. The membrane is a thin reed, and a metal plate attached to the instrument slides over it for protection. The Hmong in Viet Nam also use a related mirliton flute.

The information above on the making and mounting of the mirliton was gathered directly from traditional Chinese makers by Ted Goodfellow as a teenager in the Merchant Marine in the 1930s. Some years later, he recounts, he put the knowledge to good use during tenure in the woodwind section of the Portland Symphony Orchestra. An oboe solo within a larger work came his way at a time when, under financial constraints, he had put his oboe in hock. Prior to rehearsal he prepared a bamboo head to fit the body of his Boehm flute, and provided it with a mirliton hole covered by fishskin held in place by, yes, garlic juice. Played on this ingeniously contrived quasi-oboe, the solo went smoothly; and the conductor, so the story goes, was none the wiser until he looked up from the score, saw the instrument, and forbade its use in the performance.

In addition to the Goodfellow Mock-Oboe, a couple of short-lived 19th century European wind instruments incorporated mirlitons. One was the Flauto di Voce, a modified alto flute patented in 1810 in London by one Malcolm McGregor. The membrane hole appeared in the second body joint. The second and more interesting 19th century European mirlitons -- actually a mirliton family -- were the Sudrophones, patented in 1892 by the Frenchman Francois Sudre. These were brasswind instruments (lip buzzed, with valves), proportioned much like the Saxhorns that had appeared 50 years earlier, but more closely folded in on themselves. The family contained a full complement of members from soprano to contrabass, plus two cousins with different bore shapes. A brass cylinder perhaps six inches long and an inch in diameter was mounted on the side of the horn, near the bell. The side of the cylinder tangent to the horn had an opening into the interior of the tube.



SUDROPHONE, from a drawing in Francois Sudre's 1905 catalog.

On the opposite side of the cylinder was another opening to the outside air. Within the cylinder was a movable device which held a membrane of goldbeaters skin or silk. In one setting it positioned the membrane over the hole to engage the mirliton effect; in the other it disengaged it by blocking the hole with a solid stop.

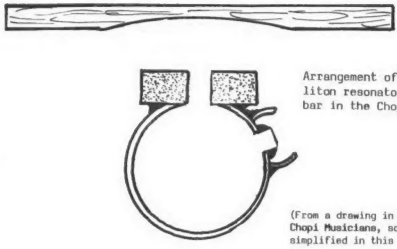
Mirliton Marimbas

In Mozambique, South Africa, Zaire and Sudan, there are prominent musical traditions centered around orchestras of mirliton marimbas. The marimba bars are provided with tuned Helmholtz resonators in the form of calabashes below, and mirliton membranes are set over holes in the calabashes. With strong coupling between well-tuned bar and resonator, the vibrations within the calabash are strong enough to activate the mirlitons and give an edge to the tone considered essential to the effect of the instrument.

The culture of these instruments is best documented for the Chopi (also spelled Tsopi, Tchopi, etc.) in Mozambique. Hugh Tracey's **Chopi Musicians: Their Music, Poetry and Instruments** (New York: International African Institute, 1948) describes the instruments and the surrounding music culture very completely.

The Chopi call the instrument Mbila. Similar mirliton instruments in Zaire are called madimba, or something linguistically akin. Mbila bars are traditionally made of fire-cured sneezewood, a dense, oily and increasingly rare local wood. The instruments are made in five sizes, covering the entire musical range. Few tools are used in construction: a sharp adze, a home-made chisel, and a metal spike for burning holes. Beeswax is used to secure and seal all joints around the resonators, and to fine tune the resonators by building up or closing off their mouths under the bars. Rather than further detailing the general construction of the instrument here, let us look more closely at the mirliton arrangement.

The mirliton hole is about 3/4 inch in diameter, burned in the side of each calabash. A rim of beeswax about ¼ inch high is built up around the edge of the hole, and the membrane is pressed over and adheres to this. The seal around the membrane must be air tight to preserve the tuning and resonance of the calabash, but still loose enough to buzz. The great advantage of the wax is that it readily makes a good seal, but can also easily be adjusted and readjusted. For the membrane the Chopi traditionally use cattle peritoneum or the diaphragm of jerboa (a small rodent). Less common alternatives are bat's wing and cigarette paper. Spider's egg sac membrane, a favored material for mirliton membranes among some other peoples, is sometimes used as well. An additional short, tubular section of gourd shell, 1½ or 2 inches in diameter and about an inch high, is placed over the membrane and secured with more beeswax, forming a sort of shallow cylinder around it. In addition to protecting the membrane, the open-topped chamber thus formed is said to round



Arrangement of the mirliton resonator below the bar in the Chopi Mbila.

(From a drawing in Tracey's **Chopi Musicians**, somewhat simplified in this rendering).

the tone and prevent its giving too harsh an edge.

Experimental Builders Working With Mirlitons

And finally, having visited Asia, Africa and ancient Europe in search of mirlitons, we come home to the present time and place. Are many contemporary instrument builders in the West using this principle in their designs? I've not heard of any. But it seems like a potentially interesting area for further exploration.

THE BAMBOO ORCHESTRA
Nine Self-Playing Bamboo Machines

Text and diagrams by Ernie Althoff

Ernie Althoff is an Australian composer, performer and instrument maker, known for his work involving timbre, texture and societal context. One facet of this work has been the creation of random music making machines using commonly available materials (see EMI Vol. II #6 for a review of a recording of one such). In the following article he describes a singular ensemble of machines employing bamboo sounding elements driven by cassette and turntable motors.

For more information on compositions and instruments by Ernie Althoff, contact him at 9 Stanhope St., Armadale, Victoria 3143, Australia.

PROLOGUE

When I started my work as a composer and performer of experimental music, lack of funds forced me into the low-budget ethic of using cheap electronics, toy instruments, found objects and, gradually, instruments of my own design and construction. Percussion material featured fairly strongly. I am still using these categories as my sound sources, although in far more sophisticated situations than when I started out; for I have discovered that these materials help to communicate the "politics" of de-mystification and participation of much of my music.

In 1981 I built my first music machine. This was a cassette recorder with a T-arm structure mounted on the take-up capstan, from which were suspended two beaters which hit an array of sound sources placed around the machine. The unpredictable randomness of the sounds as the beaters hit an object and then bounced off to miss the next few was an immediate attraction for me. Here was a way to get the sounds and rhythms I wanted for my then texture-based pieces better than from any human player -- and one didn't need to cajole it into playing in your piece either! Soon, little record players with 16 and 78 rpm speeds and oscillating electric fans made their debuts as the central drive units, and the "Ernie builds a machine" and "Machines and me" performances were born. Audiences warmly took to the machines and their slightly dubious appearance, and were always charmed by the sounds. I began to be well-known as a builder of machines. In 1986 I developed a new system: instead of the beaters moving through a field of static objects, I started to design machines where the beater was suspended like a pendulum, usually from a bamboo tripod, to be knocked around by the sound sources on the rotating turntable platter.

In May 1988, my local council Community Arts Officer asked fellow composer Warren Burt and me if we would like to create an installation -- a roomful of sound -- for the 1988 Community Arts Festival. The room we were offered was an excellent space in an old mansion, so we readily agreed. I build a large tentlike structure down the center of the room with six pendulum-type machines under it, plus a seventh T-arm machine. Warren installed a synth keyboard and sampler, running little loops sampled from my machines through four small speakers around the room. This combination of hi-tech and low-tech played enchantingly all day for a throng of visitors.

During the day I noticed how well the bamboo component of this installation both looked and sounded, and the following day resolved to start work on a project to build a set of eight machines, all making sounds from bamboo, and all using different mechanical means to produce the sound. My theory was that if all the sounds were different enough in timbre, pitch and rhythm, then all machines could play together fairly homogeneously. Thus the concept of "The Bamboo Orchestra" was born. The number of machines changed to nine when I found an excellent little record player for $3 (Aust) in a second-hand shop whilst building Machine No. 8. It was too good to pass up. I found it easy to obtain different types of bamboo -- there's lots of it growing in backyards all over Melbourne, Australia (where I live), and people were only too pleased to let me cut some of it down. I think both history and musicology amply demonstrate the excellence of bamboo as a musical resource. Over the seven weeks in June and July 1988 that I took to build the machines, I taught myself many of the skills needed to work with it, e.g. how to drill a hole through a thin piece of bamboo without splitting it. Some of the design concepts worked perfectly first time, and some machines evolved gradually through trial and error into different forms, but I've always considered myself an experimenter in my musical approach, so I didn't mind this at all.

Apart from an appearance by Machine Number 9 in a piece performed in September '88, the total Bamboo Orchestra was first shown to the public at an exhibition at the Meat Market Craft Centre, Melbourne, on November 4, 5, and 6, 1988. There, the machines were set up on waist-high grey exhibition stands, connected to power, and superbly lit, in a square space with a polished wood floor which brought out the brightness of the sounds.

Response was excellent! People of all age groups made comments to me about the machines and how much they enjoyed the sounds. I got even more ideas from this. It was heartening as well to see how many people can still "actively listen." People were also delighted by the new uses for the humble turntables, particularly older folk.

The next stage was the recording of the ma-

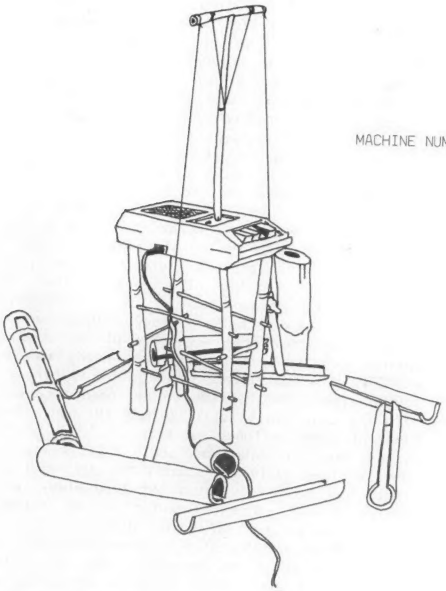
chines, with sections of this article re-written as a voice-over, by the Australian Broadcasting Corporation in January 1989, to be made into a program and broadcast later this year.

THE MACHINES THEMSELVES

The machines are titled by number according to their succession of construction, but to describe them it would probably make more sense to regroup them according to "ways of playing" (this gets more and more like an orchestra, doesn't it!).

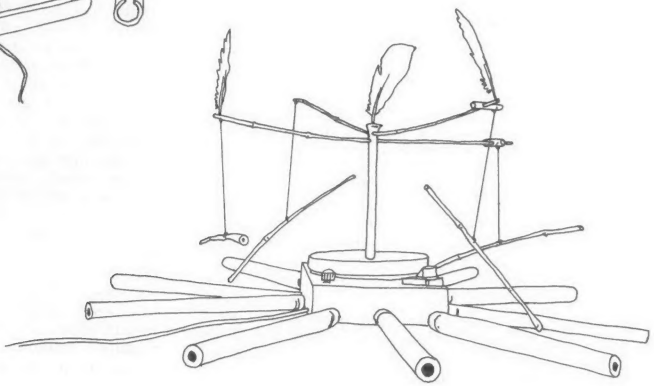
MACHINES NUMBER 1, 6 and 9 all use the T-arm system of rotating suspended beaters though a field of static sound sources, with both 6 and 9 using four beaters each and 1 having only two.

MACHINE NUMBER 1 is cassette recorder powered, thereby rotating in the opposite direction to all the other machines -- a nice touch. Suspended from a height, two bamboo beaters with small seashells as extra weights knock an array of large split pieces of bamboo, of about 50 mm diameter, giving loud, low-pitch "wood-block" sounds. An older homemade bamboo slit drum is also used, as well as one larger piece of thick bamboo standing up. Originally, the recorder rested on a small metal stand, but I went back and built the "rustic" little bamboo stand seen here after notions of "purity" set in. All sounding pieces are differently pitched (here as for all the machines).



MACHINE NUMBER 1

MACHINE NUMBER 6

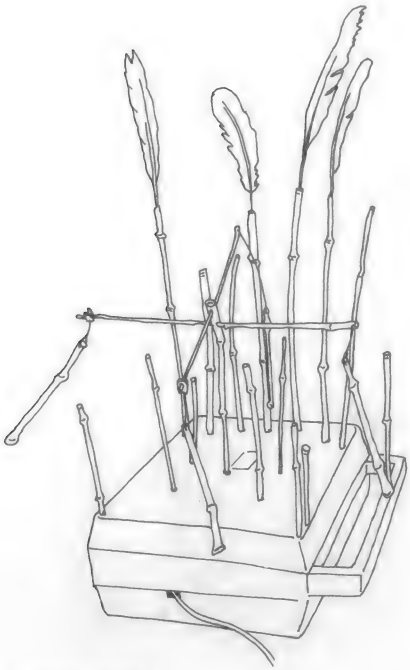


MACHINE NUMBER 6 has a very delicate "click-click" sound, the four thin beaters being suspended 10 mm from their centers of balance, giving them very light and gently bouncing movements. With superb randomness they strike ten thick bamboo tubes with one end closed (diameter 30 mm) arranged radially around the small turntable. The machine rotates at 16 rpm. The feathers on some of the machines, as well as being decorative, visually accentuate the small jerking movements of the machines by tremulous wobbles. The timbre of this machine also alters if set up on carpet, wood floor, concrete or hollow exhibition stand.

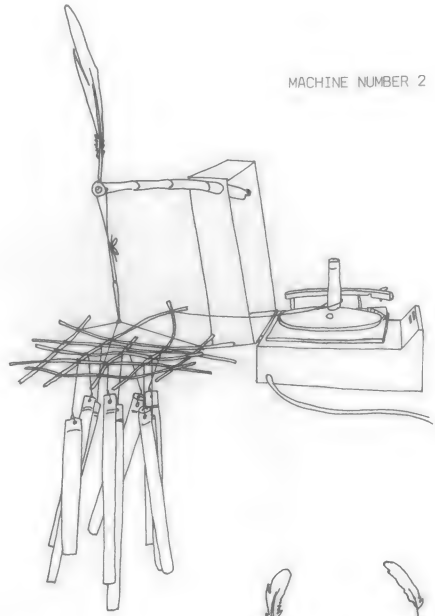
MACHINE NUMBER 9, the last to be built, utilizes all the scrap ends of bamboo left over from the other machines. I discovered a very important feature in building this one: here, the plastic case of the 33 rpm record player acts as a resonator for the thin bamboo tines pushed into little holes drilled in the lid. The four beaters are rotated by the T-arm joined to the turntable spindle through a hole in the lid via a small plastic tube sleeve, and they savagely bash at the eight long and seven short tines, giving a very "bonky", somewhat kalimba-like sound.

MACHINES NUMBER 2, 3, 4 and 7 all activate concussion idiophones: bamboo "windchimes" shaken by different means.

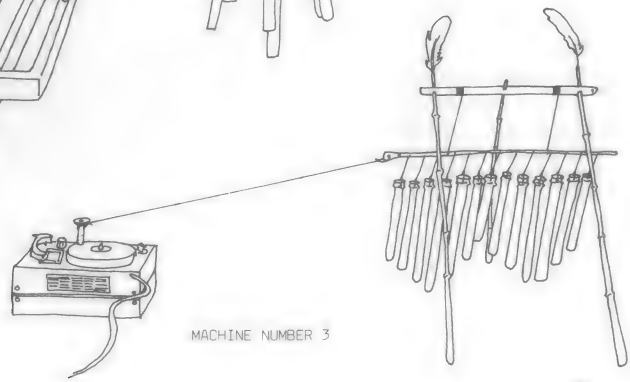
The off-center post attached to the turntable rotating at 33 rpm of MACHINE NUMBER 3 jerks a



MACHINE NUMBER 9



MACHINE NUMBER 2



MACHINE NUMBER 3

11

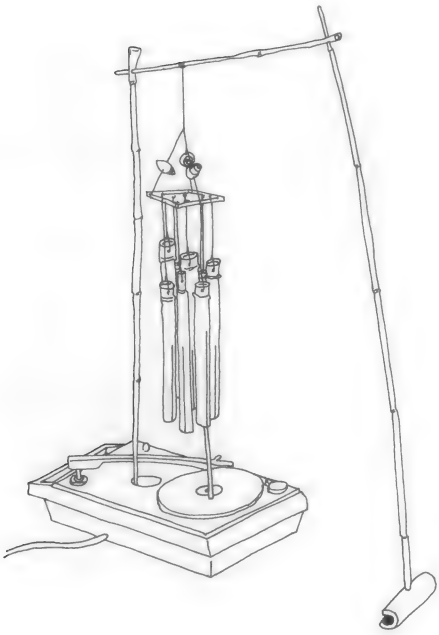
string attached to a 13-pitch linear-construction chime set, causing it to swing side to side within its support structure, with the chimes hitting their immediate neighbors. I got the parallelogram idea from the horizontally suspended beams used to ring large Japanese bells. The machine makes gently rhythmic soft sounds, reminding many listeners of the sounds of running water.

A string connected to an off-center post also tugs at the chimes of MACHINE NUMBER 2, likewise running at 33 rpm, but this time the flexibility of the long bamboo supporting pole causes the nine hardwood bamboo chimes, arranged in a three-by-three formation, to dance around vigorously, emanating a very bright, high-pitched clicking. The chimes are suspended from a woven grid of very thin bamboo sticks knotted together at the cross-points. Here, the feather really shows the movement of the pole.

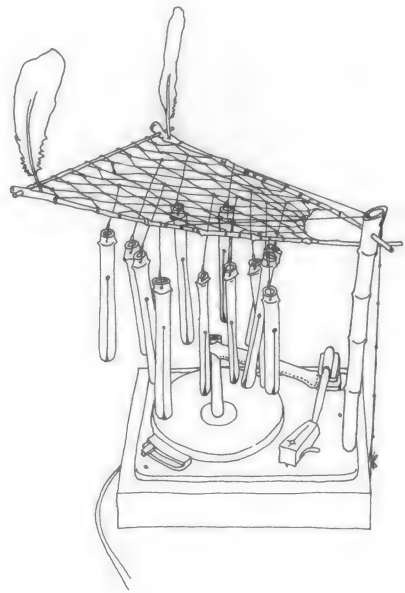
MACHINE NUMBER 4 uses the same type of bamboo as Machine Number 3, but this time the eight chimes are all slit, giving a much drier, more clattery sound. A small perspex rectangle is used for suspension. These chimes are "stirred, not shaken," by a small bamboo post fixed just off-center on the 33 rpm turntable, protruding right up into the chime cluster. The rotation causes individual chimes to hit against the others, and also causes the whole assembly to twist clockwise on its string, to suddenly jerk back with an increase in volume when it can take no more.

MACHINE NUMBER 7, built of hard, black bamboo, has twelve slit chimes suspended from points on a triangular string net above the turntable set at 16 rpm. The net supports are also black bamboo and the whole structure can be dismantled into a neat bundle. The chimes are set in motion by the rotating sweep-arm attached to the central post on the turntable, and make a very loud, constant texture of sounds as they slide over the arm and swing against each other. There was another sound when I first tried the machine out; I discovered it came from the sweep-arm hitting the chimes, so I covered it with a felt sleeve. Again, "purity"

MACHINE NUMBER 4



MACHINE NUMBER 7



strikes!

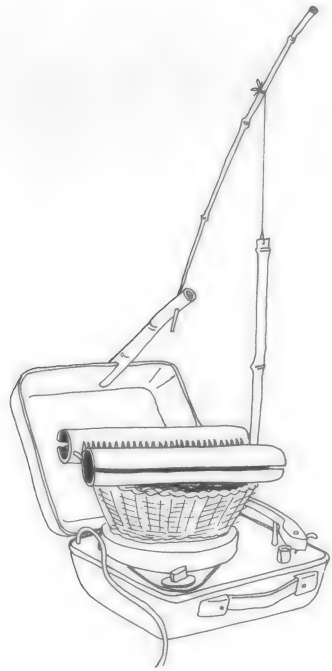
The last two machines are the orchestra's "rhythm section," and scraping and rubbing motions produce their sounds.

MACHINE NUMBER 5 has a pendulum of black bamboo, suspended from a structure extending from the lid of the record player. The player is set at 16 rpm. The pendulum rattles between two large pieces of rotating split bamboo (the same bamboo as for Machine Number 1) with rows of notches filed along the inside surfaces, and two small bamboo pegs joining the pieces at both ends, also stopping the pendulum's escape. The small cane basket with a hole in the bottom to fit over the spindle provides an embarrassingly easy method of suspension for the two sounding pieces, which make a steady "scrape-scrape" in two low pitches.

As can be seen from the diagram, MACHINE NUMBER 8 is the most complex in its form, and also the hardest to set up and calibrate correctly! Eight small radially-aligned pieces of split bamboo attached to the 16 rpm turntable strike the tongues at the ends of four suspended differently-pitched bamboo tubes closed at the top end. This gives a very rhythmic steady four-pitch melody as the tubes are tripped up and fall against the next piece of split bamboo. The tubes appear to be walking around the center-piece, which consists of two large bamboo pieces of Japanese origin (again purchased at a second-hand shop -- I think they were decorative vases or drinking mugs). The piece on the turntable is positioned slightly off-center, and as rotation occurs, the upper piece, suspended upside down, rubs its opening edge against the lower one. The opening between the two opens and closes, providing a wavering note from the resonance chamber made by the two pieces; the orchestra's bass drone.

MACHINE NUMBER 8

MACHINE NUMBER 5



HANS REICHEL'S PICK-BEHIND-THE-BRIDGE HARMONIC GUITAR

By Bart Hopkin

In EMI's October 1985 issue was a description of Glenn Branca's Harmonics Guitar, an instrument designed to take advantage of a simple but elegant technique for isolating string harmonics electroacoustically. As it happens, guitarist Hans Reichel, working in the seventies, discovered the same technique, and also developed instruments to realize it. With the two musicians operating independently and apparently unaware of one another's work, the same basic idea gave rise to very different instruments and playing styles. I had an opportunity to hear Hans' instrument recently and to speak to him about it. Additionally, he has recently written an article describing it which appeared in **Guitar Player** magazine (information below). What follows here is a brief recapitulation of the basic idea and Glenn Branca's realization of it, followed by a look at Hans Reichel's approach.

The basic idea is this:

In its simplest form, the set up can be conceived as an unresonated zither (i.e., a board with strings on it) with a middle bridge appearing somewhere along the string length, so that the string lengths on either side of the middle bridge are playable. There is an electromagnetic pickup under the string on one side of this bridge but not the other. To achieve the effect we're talking about here, the string is plucked on the no-pickup side. The resulting vibration of the plucked string segment is only minimally audible, since the board alone is not an effective acoustic resonator and there's no pickup under the string at that point. However, if the fundamental of the plucked string or any of its overtones happen to agree with those of the string segment on the opposite side, vibrations at those frequencies will readily be communicated across the bridge to and duplicated in the unplucked string segment. There they will be sensed by the pickup and sent to an amplifier. The bridge, in effect, acts as a selective filter for harmonics.

The harmonics that reach the amplifier and eventually the ears with this technique are remarkably clean and lucid; at the same time the sound has appropriately been described as ethereal. There is no plucking sound, but the onset of the note is fairly quick, and the decay quite slow. The sound can be sustained indefinitely by repeatedly plucking on the silent no-pickup side. With some further refinements, a remarkable richness and variety of harmonics can be generated easily, and some wonderful sounds become possible.

Further refinements, I said above. The next stage in the development of the idea is to somehow make it possible for the player to modify the vibrating lengths of one or both string. This enables him or her to govern where there will be agreement between the harmonics of the two string segments, and in doing so select which vibrations will be transmitted across the bridge from the plucked, no-pickup side to the unplucked pickup side, and eventually be heard.

Glenn Branca approaches the question in this manner: He sets up the zither so that the two open string segments are identical in length. There are no frets on either side. The pickup side is not plucked or modulated in any way. The no-pickup side is plucked in the usual fashion, and its vibrating length is modulated using a sliding steel, Hawaiian guitar style. Whenever its vibrating length or one of the associated harmonics corresponds to a harmonic in the open string on the other side, communication takes place.

The only pitches available in this arrangement are the natural harmonics of the open half-string length on the pickup side. This limitation is less restrictive than it might seem: the middle bridge system readily isolates very high harmonics with great clarity, and in those upper reaches of the harmonic series the number of harmonics available per octave increases dramatically, making for a very full palette of pitches all logically related by the series. Just plucking the string and sliding the steel over its length produces an amazing cascade of audible pitches. Specific harmonics can be selected by placing the steel at appropriate nodal points. Glenn has facilitated this in his instruments by placing a position chart under the strings marking the locations of the nodes for specific harmonics.

Hans Reichel's instrument is modeled more closely on a conventional guitar. It is more demanding both to build and to play, but offers a correspondingly wider range of musical possibility. The pickup side is essentially identical to a

AN ELECTROACOUSTIC STICK ZITHER WITH SOME UNUSUAL PROPERTIES: Plucking the left side of the divided string produces little sound because no pickup is there. But if there is any agreement in frequency of fundamentals or overtones between the two sides, those shared frequencies will be communicated to the right side, where they will be sensed by the pickup and can be amplified. The question then becomes, how to control the resulting sound by somehow governing which frequencies will be shared? As this article explains, Hans Reichel and Glenn Branca have taken very different approaches.

14

normal electric guitar, complete with frets, although it is shorter in scale. The strings on the no-pickup side, running from the bridge (set near the waist) to the butt end, are shorter than the pickup side strings. This side too has frets, albeit fewer in number and in an irregular pattern. Hans deliberately chooses a complex ratio between the two string lengths: the no-pickup side matches the distance from the bridge to the 14th fret of the pickup side — in other words, one side is a little under half the length of the other. This unbalanced relationship reduces the incidence of unintended communication between the two sides.

The presence of frets on both sides means that a wide variety of correspondences can be set up between the two string lengths. In theory the equal tempered fret spacing throws off some of the harmonic relationships, but in practice it comes close enough to the mark so that functioning is not inhibited. In addition, strings can be bent to achieve more precise intonational match-ups. To facilitate string bending the fretboard on the no-pickup side is scalloped, and its tailblock is spring mounted.

Playing this instrument ideally would require three hands (two for fretting and one for plucking), but with hammer-on technique, plus judicious use of open strings, the impossible becomes possible. Still, it is demanding in physical technique, and the instrument demands conceptual reorientation and growing familiarity with a new set of relationships, making its mastery is a serious undertaking.

For a complete description of Hans Reichel's pick-behind-the-bridge guitar, see his article "Crossing the Bridge" in **Guitar Player** Vol. 23 #1, January 1988. For an account of another of his amazing instruments, this one a bowed wooden idiophone, see "Dachsophon" in EMI Volume IV #3, October 1988.

Both the pick-behind-the-bridge guitar and the dachsophon can be heard on the LP **The Dawn of Dachsman,** available from Free Music Production, Behaimstrasse 4, 1000 Berlin 10, West Germany.

For more on Glenn Branca's Harmonics Guitar, see "Glenn Branca and the Third Bridge" in EMI Vol. I #3, October 1985. In addition, Glenn has generously given EMI permission to provide his diagrams of the instrument to readers who request them -- if you are interested, write us at PO Box 784, Nicasio, CA 94946.

HANS REICHEL'S PICK-BEHIND-THE-BRIDGE GUITAR, in several versions. The unfinished version at left shows space provided for the spring-mounted tailpiece and lower fingerboard.

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1/1: The Quarterly Journal of the Just Intonation Network, David B. Doty, editor. Serves composers, musicians, instrument designers and theorists working with tunings in Just Intonation. One year membership includes subscription. Individual, $15 US, $17.50 foreign; institution $25. 535 Stevenson St., San Francisco CA 94103. (415) 864-8123.

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15

Books

SYNTAGMA MUSICUM
by Michael Praetorius

Originally published in Germany, 1615-1620. Volume II reprinted in 1986 by Clarendon Press, Oxford, translated and with an introduction by David Z. Crookes.

HARMONIE UNIVERSELLE
by Marin Mersenne

Originally published in France in 1635. Reprinted in 1957 by Martin Nishoff, the Prague, translated and with an introduction by Roy E. Chapman.

GABINETTO ARMONICO
by Fillipo Bonanni

Originally published in Italy in 1716 and 1723. Reprinted in 1964 by Dover Publications, Inc., New York, under the title **Antique Musical Instruments and their Players**, with an introduction by Frank Ll. Harrison and Joan Rimmer.

Reviewed by Bart Hopkin

In Europe, the mechanical reproduction of printed documents gradually took hold after the appearance of Johann Gutenberg's printing press in Germany around the middle of the 15th century. The following century brought with it the period of exceptional growth in European culture known as the Renaissance, and along with it an early flowering of modern western scientific thought. Through the legacy of Herr Gutenberg, there appeared during that time a number of encyclopedic works, in which one learned individual attempted to encapsulate everything of importance that he knew.

Music was a natural and important topic for such compendiums. It probably would not be accorded the same respect now: while we are accustomed to paying homage to the role of music in our culture, few people today would maintain that a proper understanding of the conventions of musical practice is essential to the well being of the body politic, or central to our understanding of the physical universe. But in the seventeenth century, divisions between the arts and the sciences were not as clearly drawn as they are now. Comprehending the laws of music was felt to be as important as, and in fact linked to, comprehending the motion of the stars and planets. And central to an understanding of the laws of music, if we can judge by the literature that comes down to us, was an understanding of the instruments of music.

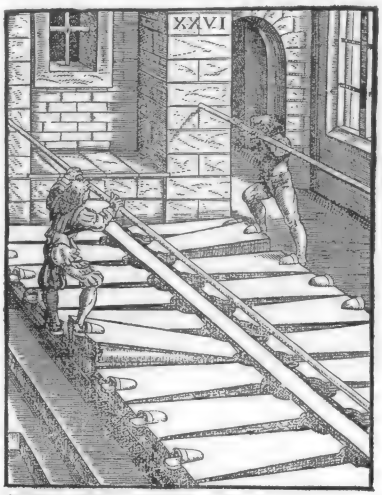
We will look now at two of the great European encyclopedic works on the practice of music in the sixteenth century: Michael Praetorius' **Syntagma musicum** and Marin Mersenne's **Harmonie Universelle.** Both of these have extensive sections devoted exclusively to musical instruments, and both have a liberal complement of beautiful and highly informative engravings. There are other works on music and musical instruments that have come down to us from the same century: Sebastian Virdung's **Musica Getutscht** (Basil, 1511) for instance, or Martin Agricola's **Musica instrumentalis deudsch** (Wittenburg, 1529). But these lack the comprehensiveness and authority of Praetorius and Mersenne; also (this is important) they don't have the same complement of profuse and careful illustration.

The third source we'll look at here is a little different: Bonanni's **Gabinetto Armonico** is from a slightly later period. It is also a lighter piece of work and lacks the authority and scientific purpose of the others. It is included here for one reason: Like Praetorius and Mersenne, it has wonderful pictures.

Experimental Musical Instruments is nominally devoted to new instruments. The instruments shown in these books are definitely not new. On the other hand, some of the best new ideas turn out to be the oldest ideas. There is a lot to be learned from these books about possibilities for musical sound.

SYNTAGMA MUSICUM

Praetorius' "music encyclopedia" appeared in three volumes between 1615 and 1620. Volume I, "Musicae artis analecta," deals with ancient ecclesiastical and secular music; Volume III, "Termini musici," covers aspects of musical form



Working the organ bellows, in an illustration from Praetorius' **Syntagma Musicum**

16

and practice in Praetorius' time. The second volume is the one that interests us here: it is "De Organographia," devoted to musical instruments. (The modern edition of **Syntagma musicum** referenced here is a translation of this second volume only.)

"De Organographia" was originally written in the vernacular, which is to say in German rather than the Latin then customary in scholarly works. Following some introductory materials, the body of the work contains 160 pages of text, divided into two symmetrical parts: the first eighty pages describe all manner of portable instruments; the second eighty cover the organ. Following all this is the "sciagraphia," or gallery of instruments. It contains forty wood engravings rendered, for the most part, to scale and with great accuracy, and indeed quite beautifully.

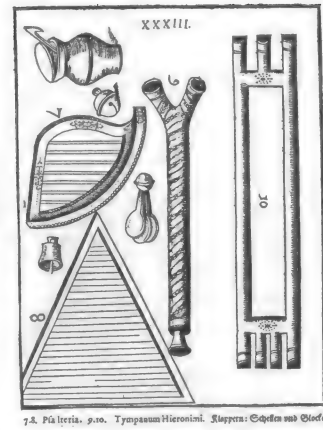
Much of Praetorius' language is quaint and flowery to modern ears, laden with the obsequious observances and literary references that were the custom of the time. An opening dedication to the Leipzig town council, for example, is addressed to, in Crookes' translation: "The most worshipful, the most honorable, the most erudite, the most wise, the most excellent, Lord Mayor and the entire Council of the City of Leipzig." This is supplemented with "gracious masters" and "mighty patrons" on the following line, and the entire cumulative string of adjectives is then repeated verbatim in the opening words of the dedication.

The first pages of the text proper lay out Pratorius' approach to the categorization of musical instruments. Creation of such systems has become a favorite activity for latter day organologists; Praetorius' approach, however, is valuable only insofar as it establishes an order for the book at hand. In the next section, following some definitions of terms, there is a series of charts giving pitch ranges and tunings of the instruments to be discussed.

The descriptions of individual instruments follow. There is no standard format here. Praetorius simply provides whatever information strikes him as important in each case. Most of the descriptions are detailed, accurate and complete; a few are lacking in one way or another.

This descriptive section, in conjunction with the collection of illustrations appearing in the Sciagraphia at the end, has been of the greatest interest and value over the years. Along with surviving instruments and some iconographic evidence, the drawings and descriptions have been one of the essential sources of our knowledge of early European instruments.

It was Praetorius' stated intention to be fully inclusive in this work; to present all manner of known instruments. As it happens, the folk instruments and exotic instruments known to him get a somewhat perfunctory bow. Percussion instruments are not accorded high status in Praetorius' world, but a fair sampling is represented. There are a number of plates and descriptions which attempt to recreate instruments referred to in the bible. Some of these stretch the reader's credulity a bit with their fanciful depictions.



Some of Praetorius' renderings of biblical instruments — questionable depictions in an otherwise rigorously accurate source.

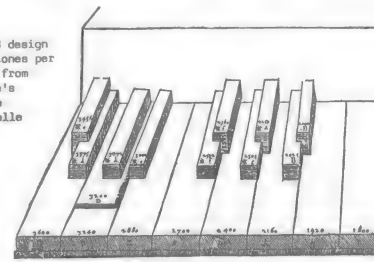
7.8. Psalterii. 9.10. Tympanum Hieronimi. Klappern: Schellen und Glocken.

The great strength of **De Organographia**, without a doubt, lies in the presentation of European winds and strings. In this area, an exuberant abundance of shapes and forms testifies to the richness of human imagination in the Renaissance -- it's wonderful.

This contemporary edition includes a preface and introduction by the translator, David Crookes. They are informative, reasonably to the point, and personally engaging. Crookes has also provided a well-researched commentary, in the form of extensive footnotes to the text explicating much that might otherwise be unclear to modern readers.

HARMONIE UNIVERSELLE

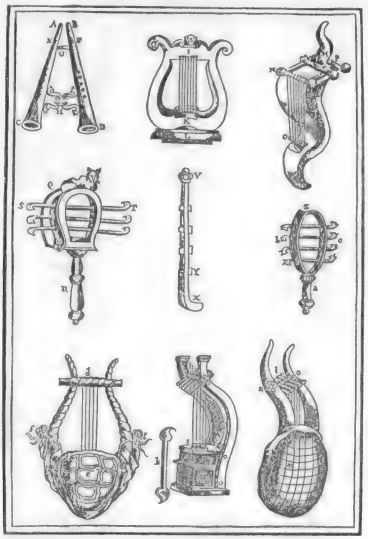
Like the **Syntagma musicum**, Marin Mersenne's **Harmony universelle** was written to be a complete musical encyclopedia for its day. It takes the form of seventeen books, the first seven of which are devoted to musical instruments. (As with the Praetorius, the translation referenced above presents only those books devoted to instruments.) The first of these serves as an introduction and does some groundwork in fundamental acoustics. The next three are devoted to string instruments, followed by books on winds, the organ, and finally percussion. A great deal of space is devoted to certain prominent instruments, in particular lute,



Keyboard design for 19 tones per octave, from Mersenne's Harmonie Universelle

trumpet, organ and church bells. Most other important European instruments of the time appear, and a few oriental instruments as well, but Mersenne does not reprise Praetorius' effort include all known instruments.

Beautiful woodcuts and engravings appear throughout, although standards of accuracy are not as high as with the **Syntagma musicum.** Mersenne's verbal descriptions, on the other hand, are more systematic and complete than Praetorius'. He also



Mersenne's ancient Greek and Roman instruments.

presents musical examples in tablature for the various instruments. Mersenne was a mathematician and scientist, and this orientation is reflected in the clarity and precision which characterize most of the language, and in the generally orderly presentation of the material.

In the process of introducing his material and then describing the instruments, Mersenne manages to touch on an impressive range of related topics, some interesting in their own right and some interesting for what they reveal about the thinking of the time. Some examples of the depth and breadth of his discourse:

In his acoustical discussions in the first book, he emphasizes strings, using the monochord as his model. He continues with a knowledgeable discussion of string manufacture, and how to distinguish good strings from bad -- an important skill at a time when musical strings, made of natural sheep gut or hand-pulled metal wire, might often prove to be less than perfectly uniform. Here and at various points later in the work he covers questions of string scaling, tension and breaking points. During the discussion of lutes, he addresses questions relating to fretting and temperament. When it comes to tuning for keyboards, he proposes designs for a seventeen-tones-per-octave arrangement. To get a handle on the question of pitch standards -- more slippery in his day than ours -- he suggests that composers give a frequency for one of the opening notes at the start of each piece. Tempo, he quite reasonably suggests, could be indicated by pendulum lengths. He also delves into the laws governing the mechanics of levers, the better to understand keyboard action. His knowledge of the technologies of the day continues to stand him in good stead in an extensive discussion of bell casting, based in an understanding of metal founding techniques of the day, as well as the science of chemistry, 16th century style.

Mersenne proposes several new instrument types, none of which seem to have passed into regular usage. Among them are a spinet sounded by hurdy-gurdy-like rotating wheels (an idea often proposed but never successfully popularized), a ¼-tone harpsichord, a combination of spinet and organ called Lyra Barbarina, and an oversized harp which Mersenne dubbed the "Harmonic Pyramid."

GABINETTO ARMONICO

Fillipo Bonanni was neither a musician or a scientist, but something of a humanist. He was a Jesuit, living in Rome, and the creator of illustrated works on various subjects. **Gabinetto Armonico,** first published in its complete form in 1723, was one of these. It consisted of 152 plates, each depicting one instrument type, accompanied by commentary. Bonanni apparently drew from a wide variety of sources. A major one is the work of Athanasius Kircher, an earlier scholar

AN "INDIAN INSTRUMENT" from Bonanni's **Gabinetto Armonico**

BONANI'S "HORN OF ALEXANDER THE GREAT"

whose library and collections Bonanni had the job of curating. He also gleaned some material from written accounts of various travellers. He seems to have studied Mersenne, but not Praetorius.

One can surmise from the introduction to the modern edition referenced above that the original text was of only modest organological value, and suffered (to contemporary taste) from excess of florid language. When the work was reprinted in 1776 in Paris, a French translation appeared along with a condensation of the original. The modern edition dispenses with the text entirely, substituting only a brief captions for each of the plates.

Gabinetto Armonico is a different sort of work from the Praetorius and the Mersenne. It lays claim to no scientific or pedagogic purpose. The illustrations are sentimental and fanciful, and contemporary scholars have been mistrustful as regards their accuracy. But it has several redeeming qualities:

First, it depicts an admirably wide range of instruments. Non-European instruments are given equal prominence with European, and folk instruments likewise are treated with full respect. Secondly, the instruments are shown with their players (always colorfully dressed and in picturesque settings), giving the collection a human element that is completely lacking in the other works. And, finally, the pictures are lovely even if they are much romanticized; the instruments are often quite odd and imaginative; in short, the **Gabinetto Armonico** is great fun to look at.

ANOTHER SUMMER'S NEW YEAR

Notes from the editor, Bart Hopkin

This issue marks the start of **Experimental Musical Instruments**' fifth year of publication. As in previous years at this time, I provide here some notes on how we're doing, where we've been and where we're headed.

Some small changes in editorial decision making have taken place in the newsletter over the last year. One is that EMI has continued its gradual inclusion of more material on interesting and unusual non-western instruments, as well as noteworthy historical or traditional western instruments. This is in contrast to an earlier orientation more narrowly focused on contemporary invented instruments. Without tying our editorial hands by an ironclad definition, I think I can outline EMI's subject area as it is currently perceived by saying something like this: EMI is interested in the great diversity of possible approaches to acoustic and electroacoustic musical sound making, with an emphasis on the unusual, the ingenious and the inventive methods that can open up wider possibilities for creative musicians.

Another small change taking place recently is that the number of pages per issue has been increased a bit. The plan has been not so much to enlarge the already substantial amount of material appearing in each issue (though there's always that temptation), but to be more liberal in space allotments to the articles that appear. This frees us to print photographs and graphics in more generous sizes. Regular readers may have noticed that the last couple of issues have had more room for big, beautiful photographs.

As in previous years, I take the opportunity of this new year's editorial to remind readers of ways in which they can have input into EMI. EMI thrives upon contributions and comments from its community. Letters to the editor are always welcome, and are a good way to communicate with the readership as a whole. We also welcome suggestions for article topics, publications or recordings for review, ideas for improvements in the newsletter, and so forth. Remember that subscribers can place ads or other blurbs in the notices column of up to forty words free of charge (write for complete advertising information). And we are always interested in article submissions. Some of our best pieces have come from readers who see in EMI an opportunity to share some valuable knowledge or ideas they possess. (If you are thinking of a major project, call this office or send a query letter before diving in.)

And another reminder: EMI's back issues, from the very first on down, are full of material that is as valuable now as it was when it first appeared. We have continued to make those issues available (some now in photocopy only). In the back pages of this issue you will find a subject index for articles appearing over the course of

19

EDITORIAL, continued from previous page

EMI's four-year life span to date. Remember too EMI's cassette tape compilations. Being released concurrently with this issue is our fourth annual cassette, featuring music of instruments that appeared in EMI during the last year. Its three predecessors also remain available, documenting aurally the instruments covered in EMI during these first four years.

Thanks to all the readers who have been with us during this last year. Stay tuned; there's more to come.

NOTICES

GROW YOUR OWN MUSIC. Bamboo Plants - Sale - 1 Week Only - June 9 through June 16. 1/2 off of hardy, quality wood bamboos in 1 and 5 gallon containers. Forty species in small, medium and timber sizes. Some variegated. Send $1.00 cash for a catalog to Richard Waters, 1462 Darby Rd., Sebastopol, CA 95472, or call (707) 823-0131 between 7-8 AM or PM.

1989 GUIDE TO UNUSUAL HOW-TO SOURCES. Describes 50 periodicals & handbooks on backyard tech, camping, crafts, finding new friends, gardening, home education, low-cost shelters, travel, woodslore, etc. All addresses are included. Free for SASE. Light Living, POB 190-EX, Philomath, OR 97370.

JUST INTONATION CALCULATOR, by Robert Rich. Macintosh Hypercard stack makes JI easy: shows scales to 48 notes/octave; calculates transpositions; reduces fractions; converts between ratios, cents, DX7II, TX81Z units; internal sound. Only $10.00. Soundscape Productions, Box 8891, Stanford, CA 94309.

MICROTONAL MIDI TERMINAL by Denny Genovese is a real time performance program for just intonation on virtually any MIDI controllable musical instrument; also a powerful tool for analyzing & constructing microtonal scales. System requirements: IBM PC, XT, AT or compatible with 128K, DOS, Roland MPU-401 or compatible MIDI interface, MIDI controller and MIDI controllable musical instrument. $99. Denny's Sound & Light, PO Box 12231, Sarasota, FL 34278.

SUSAN RAWCLIFFE, flutes & didjeridu, and ALEX CLINE, percussion, on **Personal Ethnic**. Susan plays many of her original instruments. $6.50 plus $1.50 S&H. Order from Susan Rawcliffe, PO Box 7283, Glendale, CA 91205.

THE GOURD, newsletter of the American Gourd Society, is planning a feature on Musical Instruments from Gourds for a future issue. Gourd instrument makers are asked to share their knowledge. Write THE GOURD, American Gourd Society, PO Box 274, Mt. Gilead, OH 43338.

SYMPOSIUM 89: A National Exposition of Stringed Musical Instrument Making and Repair will take place June 22-25 at the campus of Lafayette College, Easton, PA. Registration deadline June 10. For information, write Symposium 89, 14 South Broad St., Nazareth, PA 18064.

The American Festival of Microtonal Music will soon complete the 4 volumes of its **PITCH, for the International Microtonalist** series (including the latest issue, a cassette with pieces by a variety of contemporary and earlier 20th century microtonal composers), and plans to continue publishing with a series of hardbound volumes on intonation theory by ancient, 19th century and 20th century authors. Write AFMM c/o Johnny Reinhard, 318 E 70th St., New York NY 10021.

The San Francisco Early Music Society's Summer 1989 Workshops include an Instrument Building Workshop with Robert Cronin, Barbara Stanley and Lyn Elder. Dominican College Campus, San Rafael, CA, July 23 to August 12. For information: SFEMS Summer, PO Box 15024, San Francisco, CA 94115; (415) 527-3748.

RECENT ARTICLES, continued from page 24

SPIRIT CATCHERS, BULLROARERS AND OTHER IDENTIFIED FLYING OBJECTS, by Darrell De Vore, describes some of the author's outer-air instruments, including various sorts of bullroarers, hummers and other whirled instruments.

NEW, OLD AND UNEXPECTED INSTRUMENTS, by Lori I. Dunn, contains a paragraph or two from each of six builders discussing instruments they have built. Included are Barbara Pollitt's Rainsticks, Dean Drummond's Zoomoozophone, Jody Kruskal's Hand Chimes, Jamey Haddad's Hadgini Drum, Yokio Tsuji's Taiko Drums, and Tiye Giraud & Ahmondylla Best's Shekeres.

And in **Ear**'s Percussion #2 issue --

THE BEATEN PATH: NEW PERCUSSION ENSEMBLES, by Peter Griggs, briefly profiles five currently active percussion ensembles: Nexus, Repercussion Unit, the Manhattan Marimba Quartet, From Scratch, and the New Jersey Percussion Ensemble.

ECLIPSE is a score by Sarah Hopkins for handbells and whirlies (whirled corrugated plastic singing tubes), excerpted here.

TOKYO DRUM MUSEUM is comprised of several photos and a brief text introducing the newly opened Tokyo Drum Musem, exhibiting drums from around the world.

FOR WHOM THE BELL TOLLS, by Llorenc Barber, translated by Eduardo Larin, discusses the social roll and spiritual power of church bells in Spain, as well as some playing techniques.

LAND OF THE MIDNIGHT DRUM is a retelling of an eskimo story describing how drums first brought a joyful spirit to the people.

THE NATURE SOUND SOCIETY's 5th annual sound recording workshop takes place June 9 - 11 at San Francisco State University's Yuba Pass Field Station. For information contact NSS at Oakland Museum, 1000 Oak St., Oakland, CA, 94607; (415) 273-3884.

KEN BUTLER performs at Lizard's Tail, 99 S. 6th, Williamsburg, Brooklyn, NY, 10:30.

EMI BACK ISSUES: Back issues of Experimental Musical Instruments numbered Volume III #1 and later are individually available for $3.50 apiece. Earlier issues available in volume sets, photocopied and bound: Vol. I #1-6, $14; and Vol. II #1-6, also $14. Order from EMI, PO Box 784, Nicasio, CA 94946, or write for complete listing. Corresponding cassette tapes also available for each volume; see information below.

CASSETTE TAPES FROM EMI: From the Pages of Experimental Musical Instruments, Volumes I, II III, and now -- JUST OUT! -- IV, are available from EMI at $6 apiece for subscribers; $8.50 for non-subscribers. Each tape contains music of instruments that appeared in the newsletter during the corresponding volume year, comprising a full measure of odd, provocative, funny and beautiful music. Order from EMI, Box 784, Nicasio, CA 94946.

EMI'S 4-YEAR INDEX

This is a subject index for articles that have appeared in **Experimental Musical Instruments** since it began publication in June of 1985. Articles are listed here by primary topics only; passing references are not indexed.

For an issue-by-issue listing of articles along with the contents of the EMI cassette tapes, see our back issues listing, sent once a year to subscribers or available on request. Back issues are available for $3.50 apiece for Volume III #1 and subsequent. Earlier issues are available in photocopy, in bound volume sets of six issues each: Volume I set, $14; Volume II set, also $14. All from **Experimental Musical Instruments**, PO Box 784, Nicasio, CA, 94946.

21

23

RECENT ARTICLES IN OTHER PERIODICALS

Following below are selected articles relating to unusual musical instruments which have appeared recently in other publications.

THE CHEMISTRY OF A STRADAVARIUS by Joseph Nagyvary, in **Chemical and Engineering News**, May 1988.

An attempt to isolate special properties in violins made by Stradivarius, focussing primarily on chemical analyisis of the wood, wood treatments and varnishes used. Included are scanning electron micrographs of violin wood surfaces.

CHRYSALIS: A TRANSFORMATION IN MUSIC by Jerry Snider, in **Magical Blend** Issue 22, April 1989 (PO Box 11303, San Francisco, CA 94101-1001).

A look Cris Forster's beautiful instruments, and some of the thinking behind them. Photographs of Forster's rotating wheel string instrument called Chrysalis, his bass marimba, and his harmonic/melodic canon are included.

HOMER LEDFORD: MAKING MUSIC by Carol Sadtler, in the April 1989 Land's End mail order catalog.

A short article on string instruments by Appalachian builder Homer Ledford, including guitars, mandolins, banjos, dulcimers, and a "dulcibro" -- a dulcimer with a dobro-like resonator cone that appears to to be made out of wood.

FROM CANEFIELD TO CONCERT HALL, no author credited, in **Rico People & Products**, a newsletter sponsored by Rico Products, bound into **Music Trades** Vol. 137 #3, April 1989 (PO Box 432, Englewood, NJ, 07631).

A short description of commercial woodwind reed making processes, with several photographs.

THE TOXICS IN YOUR WORKSHOP by Ervin Somogyi, in **The String Instrument Craftsman**, Vol. II #8, Mar. Apr. 1989 (20085 Stevens Creek Blvd., Cupertino, CA 95014-2307).

A review of toxics and other health hazards to look out for in string instrument making shops.

STRINGS by Robin Goodfellow, in **Music For The Love Of It** Vol. II #4, April 1989 (67 Parkside Dr., Berkeley, CA 94705).

A collection of folklore and entertaining historical vignettes associated with string instruments.

GRAF'S GLASS HARP -- REPORT ON ITS CONSTRUCTION, by Hans Graf, translated by Sabine Jordan, in **Glass Music World**, Vol. III #2, April 1989 (2503 Logan Dr., Loveland, CO 80538).

An account of the evolution and construction of one man's set of musical glasses.

TECHNICAL TOPICS by Norman L. Rehme, also in **Glass Music World** April 1989 (address above).

The author briefly discusses the effects of different kinds of water and hand soaps in coaxing tones from musical glasses. Lava brand soap quickens response, he concludes, and most waters are equally effective though very soft water feels slick.

Newsletter of the American Musical Instrument Society Vol. XVIII #1, February 1989 (c/o Shrine to Music Museum, 414 E. Clark St., Vermillion, SD 57069-2390), contains, as always, photographs of a number of interesting instruments, especially in connection with their listings of recent acquisitions by various museums. Included are an unusual Euphonicon (harp piano), and a beautiful copper and brass serpent, recently made by Robb Stewart of North Hollywood, CA.

Leonardo Volume 21 #4, 1988 (2020 Milvia St., Berkeley, CA 94704), contains two excellent articles on attempts by diverse artists to establish functional relationships between music and kinetic art, and in particular music and light play:

THE FIRE OF PROMETHEUS: MUSIC-KINETIC ART EXPERIMENTS IN THE USSR, by Bulat M. Galeyev, discusses music and kinetics in the hands of Russian artists in this century.

INSTRUMENTS TO PERFORM COLOR-MUSIC: TWO CENTURIES OF TECHNOLOGICAL EXPERIMENTATION, by Kenneth Peacock, documents color-music instruments from the last two hundred years.

SOME EQUAL TEMPERAMENTS ARE MORE EQUAL THAN OTHERS ... AND DECIDEDLY MORE TEMPERAMENTAL by Paul Rapaport, in **Musicworks 43**, Spring 1989 (1087 Queen St. West, Toronto, Canada M6J 1H3).

Some background on higher order equal temperaments. Included are a several charts, such as one concisely showing intervals of several equal temperaments in cents, and their deviation from essential just intervals.

WHEN THE SOUND HAS A FORM OF ITS OWN by Hugh Le Caine, also in **Musicworks 43** (address above).

An excerpt from lecture notes written in 1957 by Le Caine, reflecting on his experience working with an advanced (for the time) tape manipulation machine he had devised. Much of these notes are reflections on the use of concrete sound sources in music.

Ear Magazine Volume 14 #1, March 1989 (325 Spring St., Rm 208, New York, NY 10013), is subtitled "Percussion #1." The following issue, Vol. 14 #2, April 1989, is "Percussion #2." Judging by what appears in these issues, the term "percussion" is interpreted loosely. In #1 --

STICK ON STONES: A LISTENER'S GUIDE TO ETHNIC PERCUSSION, by David Simons, briefly reviews a smattering of recordings of non-western percussion music.

(continued back on page 20)